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L. Cooksey 3/12/

For more information:
Laura Blankley
612.455.1762
lblankley@psbpr.com

Rockwell Automation PLC-5 Lands Stennis Space Center with a Reliable, Flexible Control System

Ever since the first rocket was launched, people have been infatuated with the vast and uncharted frontier of space. Whether it's visiting a space center or watching a shuttle launch, people are waiting to see what will be discovered next. And even though orbiting the ~~earth~~ Earth or taking soil samples from the ~~moon~~ Moon now seems effortless, decades worth of behind-the-scenes work have helped the U.S. space program get to this point. Even today, NASA must take every precaution to ensure equipment is up to the endeavor of setting foot on the moon.

As part of the initial push to put the first man on the moon, NASA established the John C. Stennis Space Center, Hancock County, ~~Miss.,~~ Mississippi in 1961 for space engine and ~~proportion~~ PROPULSION system development. Today, Stennis has three major test complexes where engine and component testing is carried out and integrated into full motion systems for space shuttles and vehicles as well as secondary testing facilities. With different products being tested throughout the facilities, Stennis was in need of an automation system that could link the operations. By integrating a control system based on a Rockwell Automation's flexible and reliable PLC-5 controller, Stennis was able to implement projects more efficiently and focus its efforts on getting the next generation of products ready for space.

Taking a New Approach

When NASA built the testing facilities at Stennis, each one was designed for standalone tasks. This led to a different ~~automation~~ CONTROL system in each ~~facility~~ AREA. Engineers equipped ~~one facility~~ EARLY FACILITIES with ~~programmable controllers and~~ HARDWIRED CONTROLS, LATER another with custom-built controls; the third ~~center was hardwired with analog switches. As a result,~~ UTILIZED PROGRAMMABLE CONTROLLERS. Stennis often reconfigured its systems from project-to-project, requiring the automation, and the staff supporting it, to adapt to these changes. Further aggravating the situation was the high number of tests conducted in each of the ~~centers.~~ LOCATIONS

"The combined facilities conduct an average of three tests per week," explained Dave Epperson, senior engineer, NASA. "And depending on the ~~product,~~ ARTICLE these tests last anywhere from ~~tens~~ TENTHS to hundreds of seconds." While this might not seem like a hectic schedule, testing the main engine of a Space Shuttle demands a considerable amount of planning and attention to detail. For example, Space Shuttle engine tests duplicate a simulated mission startup lasting roughly 500 seconds. Since the Space Shuttle technology is proven, the tests are used to increase knowledge AND DEMONSTRATE ABILITY of the product. Regardless of whether a product is being tested for the first or 101st time, the automation equipment needs to be ~~as efficient as possible, responding quickly to changes in operations. The automation~~ equipment acts as a safeguard for the test article, monitoring the product test from start to finish to prevent failures. As a result, Stennis wanted a control system that was easy to operate and maintain, but also provided the highest level of reliability.

Each project was like a clean sheet of paper and design requirements evolved with the project. As projects began to come and go more frequently (every six months to a

year), Stennis needed a more flexible, common control architecture. This was crucial as
SUBSTANTIAL TIME AND MONEY OVERHAULING
engineers were spending ~~up to XX~~ for each project ~~designing~~ the control system. And, in order to monitor its testing process more closely, Stennis required a control system with the flexibility to share data facility-wide. This meant incorporating technology that could guarantee the delivery of data. In the end, the hope was that a more versatile automation system would help Stennis implement new projects faster and more efficiently.

"The test cell environment at Stennis changes in the blink of an eye — especially when dealing with valves that open and close in milliseconds, and components that have hundreds of pounds of propellant flowing through them per second," said Epperson. "To avoid a potentially bad situation from getting worse, it's critical to have a control system that everyone understands and can depend on."

Finding a Solution

After weighing its options, Stennis turned to Rockwell Automation for a control solution. A key attraction for Stennis was the reliability of Rockwell Automation products, as well as their integration and connectivity with existing equipment. In addition, many Stennis employees were experienced with Rockwell Automation products, which helped reinforce their decision.

"~~It was critical that our facilities were operating within the same control~~
MODULAR
architecture," added Epperson. ~~"Rockwell~~ Automation allowed us to create a system that was consistent across our facilities and able to keep up with our fast-changing environment."

AS A FOUNDATION, Stennis installed two Allen-Bradley PLC-5™ controllers as the centerpiece of its control solution. One controller handles facility-wide functions and the other is dedicated

TEST CELL
to the ~~testing cycles.~~ The two PLC-5 controllers are linked together via ControlNet™, providing real-time control over the I/O points in the field and the control room. This allows engineers to respond quickly to process changes.

"Because of our fast-paced environment, we needed to have reliable, consistent delivery of data," said Epperson. "ControlNet's determinism and reliability provides us with the data we need in the timeframe we need it."

The test article is connected to sensors, which measure and record numerous factors such as temperature, pressure, velocity and liquid level. In addition, each facility has hundreds of analog and digital I/O points, made up of Allen-Bradley 1746, 1756,
AND DISTRIBUTED PROCESSORS, LIKE SLC'S AND CONTROLLOGIX
CONTROLNET OR ETHERNET
1771 and FLEX I/O, all using ~~RSLogix™ programming software~~ to relay the status to the operator. In many cases, these measurements are delivered to data acquisition systems,
HIGHLY PERFORMING INTEGRATION
allowing them to closely monitor the test environment. This helps ensure that the test is terminated if the operation exceeds its limits.

Reaping the Benefits

Stennis was able to save time and money by incorporating existing products into a common architecture, rather than designing unique products and separate systems for each facility. ~~The common architecture has also helped reduce labor costs as well.~~ Because of the consistency of the control platform, facility personnel are able to work in all areas of a facility rather than just one. This increased familiarity of control system
UP TO
operation has enabled Stennis to reduce labor by 75 percent throughout the facilities.

Stennis is committed to this architecture and has plans to deploy it in all of its test facilities. Now that the control system foundation is established, Stennis is able to give its

undivided attention to the ~~current test article~~ TESTING ITSELF. As a result, the Stennis Space Center is as relevant today as it was when its doors first opened more than 40 years ago. And, it will continue to play an indispensable role in moving the space program successfully forward for the next 40 plus years.

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